PSY

Vol. 6, No. 2 June, 1952

Canadian Journal of Psychology

THE JOURNAL OF THE CANADIAN PSYCHOLOGICAL ASSOCIATION

CONTENTS

PUBLISHED QUARTERLY

MARCH - JUNE - SEPTEMBER - DECEMBER

THE UNIVERSITY OF TORONTO PRESS

$3.00 PER YEAR

Canadian Psychological Association

1951-1952

COUNCIL

Honorary President, E. A. BOTT, *Toronto*

EXECUTIVE: President, N. W. MORTON, Ottawa; Past President, J. D. KETCHUM, Toronto; President Elect, D. O. HEBB, Montreal; Secretary-Treasurer, D. C. WILLIAMS, Toronto.

DIRECTORS: LEOLA E. NEAL, London; J. M. BLACKBURN, Kingston; R. H. SHEVENELL, Ottawa; LOUISE M. THOMPSON WELCH, Halifax; E. S. W. BELYEA, Vancouver; D. E. SMITH, Edmonton.

STANDING COMMITTEES

MEMBERSHIP COMMITTEE: Chairman, D. E. SMITH, Edmonton; L. M. THOMPSON WELCH, Halifax; F. T. SNODGRASS, Fredericton; G. L. BARBEAU, Montreal; R. [illegible] MALMO, Montreal; J. M. BLACKBURN, Kingston; R. H. SHEVENELL, Ottawa; M. [illegible] GRAPKO, Toronto; J. C. SAWATSKY, Toronto; L. E. NEAL, London; B. M. SPRINGBETT, Winnipeg; G. A. MCMURRAY, Saskatoon; E. I. SIGNORI, Vancouver; W. H. D. VERNON, Wolfville.

COMMITTEE ON PUBLICATIONS: Chairman, K. S. BERNHARDT, Toronto; K. M. HOBDAY, Toronto; D. C. WILLIAMS, Toronto.

FINANCE COMMITTEE: Chairman, W. R. WEES (Toronto), with power to add.

COMMITTEE ON PROFESSIONAL STANDARDS: Chairman, J. S. A. BOUR[illegible] Montreal; K. S. BERNHARDT, Toronto; C. R. MYERS, Toronto; N. MAILLOUX, Montreal; O. E. AULT, Ottawa.

COMMITTEE ON SCIENTIFIC AND PROFESSIONAL ETHICS: Chairman, C. R. MYERS, Toronto; S. N. F. CHANT, Vancouver; F. S. DUNLOP, Ottawa; L. M. THOMPSON WELCH, Halifax; E. C. WEBSTER, Montreal.

PROGRAMME COMMITTEE: Chairman, E. S. W. BELYEA, Vancouver.

ARRANGEMENTS COMMITTEE: Chairman, D. E. SMITH, Edmonton.

C.P.A. REPRESENTATIVE ON THE CANADIAN SOCIAL SCIENCE RESEARCH COUNCIL: C. R. MYERS, Toronto.

1952 ANNUAL MEETING
June 16, 17, 18
School of Fine Arts, Banff, Alberta

CONSULTING EDITORS: E. S. W. BELYEA (*British Columbia*); G. A. FERGUSON, CLAUDE MAILHIOT (*Quebec*); W. G. SCOTT (*Ontario*); W. H. D. VERNON (*Maritimes*); B. M. SPRINGBETT (*Prairie Provinces*).

Correspondence regarding subscriptions should be sent to the Canadian Psychological Association, 102 St. George St., Toronto 5, Canada.

Manuscripts or correspondence on editorial matters or advertising should be sent to the Editor, John A. Long, Ontario College of Education, 371 Bloor St. West, Toronto, Canada.

AUTHORIZED AS SECOND-CLASS MAIL, POST OFFICE DEPARTMENT, OTTAWA.

Vol. 6, No. 2 June, 1952

Canadian Journal of Psychology

THE CEREBRAL CORTEX AND LOCOMOTOR ACTIVITY IN RATS[1]

JOHN P. ZUBEK, *McGill University*
and
A. J. DE LORENZO, *Joliet, Illinois*

FOR MANY YEARS it has been known that lesions in the cerebral cortex may be followed by changes in the amount of locomotor activity displayed by animals. In 1876 Ferrier (5) showed that removal of the cerebral hemispheres of fishes and frogs produced noticeable increase in activity. Since that time innumerable studies—almost exclusively concerned with the role of frontal lobes in activity—have been carried out using a number of different animals. In general these studies can be said to have consistently demonstrated the inconsistency of the effect of frontal lobe lesions. It is the purpose of the investigation here reported to clarify some of these inconsistencies in results in studies on the role of the cerebral cortex in locomotor activity in the rat, and to bring these results into line with analogous findings on the higher animals.

In 1907 Franz (6) observed that destruction of the frontal lobes in cats produced increased activity in one animal but had no effect on three others. Similar operations on eight monkeys resulted in postoperative increase in four animals and decrease in the remaining four. Some years later Bianchi (4), observing six monkeys with frontal lesions, reported increased activity in four, no change in one, and decreased activity in the sixth. Similar inconsistencies have been observed by Lashley (14), Jacobsen (8, 9), Fulton *et al.* (7), and others. Most of these observations were incidental to other investigations and, more important, were handicapped by lack of objective recording devices for activity changes. In recent years the whole question has been reopened. A number of different animals have been studied using a variety of special cages equipped with accurate recording devices. Introduction of these quantitative measures of activity together with improved anatomical knowledge of the frontal

[1]This investigation was carried out in the Laboratory of Physiological Psychology, The Johns Hopkins University, Baltimore, Maryland. The authors wish to acknowledge their indebtedness to Professor C. T. Morgan for providing the necessary facilities for carrying out the study.

lobes have eliminated most of the inconsistencies in results, especially with reference to primates.

Although fairly clear-cut results have been obtained for the higher animals the situation is not too clear for the rat, despite the fact that some of the best objective measures have been developed for this animal. Some time ago Richter and Hawkes (16) reported that bilateral destruction of the frontal poles of rats (including the tip of the corpus striatum in most cases) produced a marked increase in spontaneous running—so great an increase, in fact, that many of the animals almost ran themselves to death. More recently, Beach (1) noted that frontal lesions yielded inconsistent results: of nine animals deprived of varying amounts of frontal cortex, six showed a postoperative increase in activity while the remainder showed a decrease. Furthermore, such increases as did occur were not of the magnitude obtained by Richter and Hawkes. Not only did Beach note either increase or decrease in activity following frontal lesions, but he also observed that lesions anywhere in the cerebral cortex could produce similar activity changes, although the frontal lesions increased activity more often and in greater degree than did lesions in other parts of the cortex. Because of the differential results of these reports and because the number of animals—especially frontally operated ones—was quite small in both studies, it was thought important to undertake a more extensive study of the role of the cerebral cortex in locomotor activity as measured by the revolving drum apparatus. Since the inconsistencies seemed to be greatest for frontally operated animals it was thought advisable to investigate the frontal cortex most extensively and to perform a number of different kinds of ablations in this region of the cortex. Other cortical areas were also included in the experimental design.

Procedure

Animals

Forty male rats of the Lashley strain were employed in the investigation. At the beginning of the experiment they were four months of age and averaged 220 grams in weight. Since only ten activity cages were available, the study had of necessity to be performed in four stages. Special care was taken, however, to keep the conditions of the four successive stages as nearly alike as possible, and experimental and control animals were run in all four cases. During the course of the study three animals died and another five had to be discarded because of brain infection, leaving a total of 32 animals with completed records.

Apparatus

To measure the locomotor activity level of the rats, ten standard

revolving-drum cages were used. These activity cages consist of a small living compartment attached to a ten-inch revolving drum. When the drum revolves, each revolution in either direction is recorded on an automatic counter. The ten cages were placed on a long bench located in a quiet room. The windows were blacked out and the room was put on a light-dark cycle of 12 hours light and 12 hours darkness. This light cycle was maintained throughout the course of the entire experiment.

Preoperative Tests

Prior to placing the animals in the cages, each drum was calibrated to determine the number of revolutions resulting from the momentary application of a certain force. This calibration was repeated weekly. Should calibration values vary from the original values, appropriate adjustments such as loosening or tightening the drum, oiling, etc., were made. The animals were placed in the apparatus and 24-hour activity records taken for a 25-day period. The rats were disturbed only once a day (9 a.m.) when activity recordings were taken and food and water replenished. Once a week they were removed while the apparatus was cleaned and calibrated. At the end of the 25 days the first group was removed, the drums cleaned, oiled, and recalibrated, and a new group of ten animals introduced.

Operative Procedure

On the basis of their preoperative activity scores, the animals were divided into six equated groups, five experimental and one control. The animals of two of the experimental groups were subjected to removal of either the posterior or the medial part of the cerebral cortex. The remaining three experimental groups were subjected to three different types of cortical ablations in the anterior or frontal cortex: (1) of the dorsal surface of the frontal cortex, (2) of the lateral surface of the frontal cortex extending down to the rhinal fissure, and (3) ablations of the lobectomy type, involving removal of all frontal brain tissue anterior to Level 4 in Lashley's diagram of the rat brain. By confining the lesion to Level 4 it was hoped to spare the tip of the corpus striatum. The control group of animals were all sham-operated. The operative procedure was as follows: A combination of ether and nembutal was used for anesthesia. After incision of the skin and underlying fascia, trephine holes were placed in the desired area and were enlarged with small bone scissors to expose the underlying cortex. The meninges were pierced and the tissue removed by suction with a small glass pipette attached to an aspirator. Upon removal of the desired area, the cranial musculature and skin were sutured, and the wound covered with collodion. In the

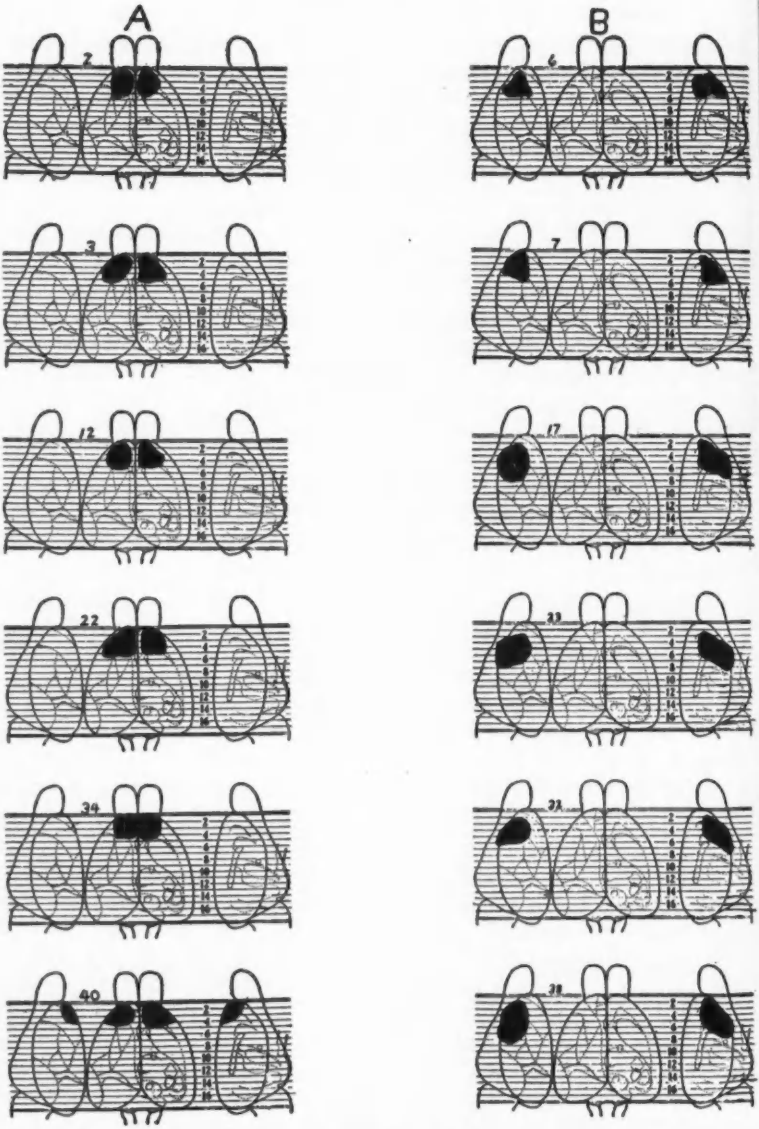

PLATE 1. RECONSTRUCTIONS OF CORTICAL LESIONS
The animal's experimental number is shown on the left of each diagram. Group A: animals with fronto-dorsal lesions; Group B: animals with fronto-lateral lesions.

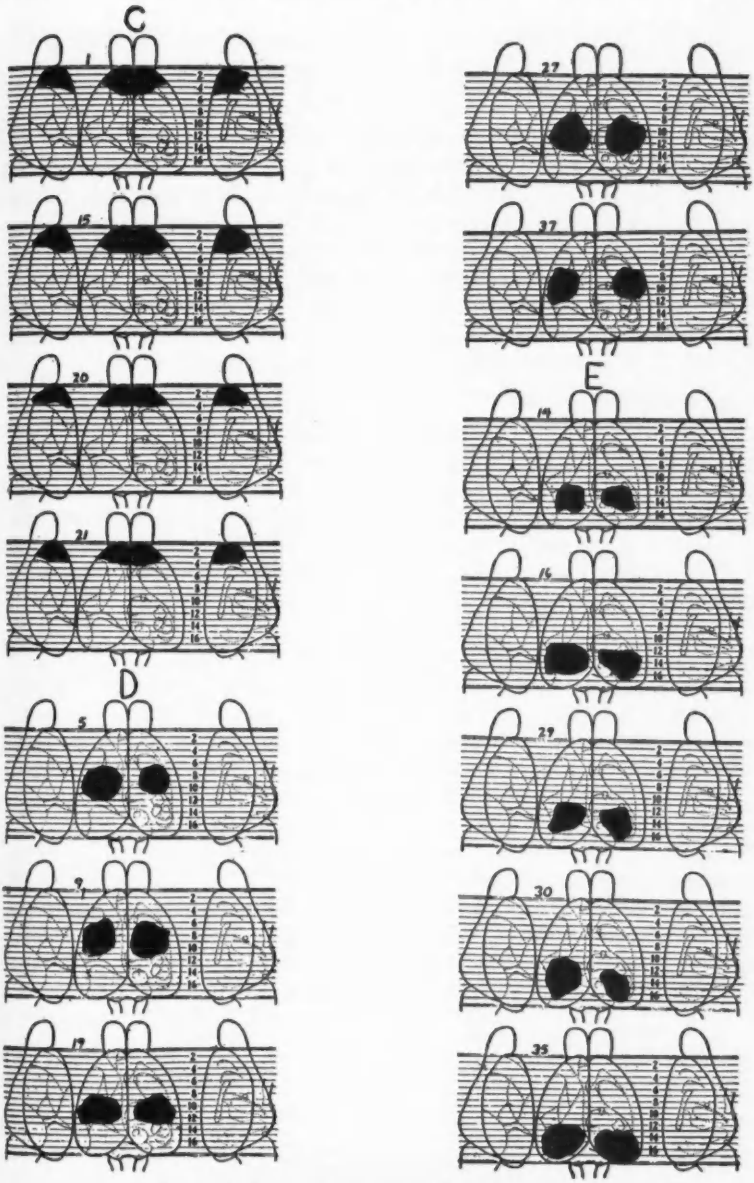

PLATE 2. RECONSTRUCTIONS OF CORTICAL LESIONS

The animal's experimental number is shown on the left of each diagram. Group C: animals with frontal "lobectomy"; Group D: animals with medial (parietal) lesions; Group E: animals with posterior (occipital) lesions.

sham operation a midline incision was made, and two trephine holes were placed in the skull but no tissue was removed.

Postoperative Tests

After a 25-day period of recuperation each of the animals was placed in the same cage that it had occupied preoperatively, the drums were recalibrated, and if the values differed much from the preoperative values appropriate adjustments were made. Daily activity records were taken for 25 days. In the statistical treatment of data only the scores made during the last 15 days of preoperative testing were compared with the scores of the last 15 postoperative days. Scores of the first 10 days of preoperative and postoperative testing were not used since during this time the animals were undergoing adaptation to the apparatus.

Post-mortem Procedures

Upon conclusion of the postoperative activity tests, the brains of all operated animals were fixed by a perfusion technique. An incision was first made in the right atrium of the heart. Next, 15 cc. of physiological saline were injected into the left ventricle, followed by a 20 cc. solution of formalin-acetic acid perfusion fluid. The brain was then removed and the lesions plotted on the standard Lashley diagrams (see Plates 1 and 2) employing the usual techniques.

Results

Anatomical reconstructions of the brains of the experimental animals are shown in Plates 1 and 2. It can be seen that the lesions are quite small, involving on the average about 16 per cent of the neocortex. Furthermore, the lesions of any one experimental group are almost of the same size although there are some small differences in lesion size among the groups. Behavioural results of the investigation are summarized in Tables I and II. Perhaps the most striking feature of the two tables is the unusual distribution of activity scores. With this type of distribution of scores one is not justified in employing the *t*-test for testing the significance of the differences between preoperative and postoperative scores. However, since no existing technique is applicable to this type of distribution, P-values will be given for whatever they are worth.

Control Group

Table I records the performance of six animals subjected to a sham operation followed by a 25-day period of recuperation. The dramatic feature of this post-sham performance is the marked drop in activity scores of four of the six rats. This decrease is especially noticeable in Rat 10 which dropped from a pre-sham level of 1,100 revolutions to a

post-sham of 45. Animals 11 and 31 showed a small post-sham increase in activity scores. Considering the performance of the animals as a whole, we find a decrease in activity of 83 per cent below that of the pre-sham level ($P = 0.30$).

TABLE I

EFFECT OF VARIOUS OPERATIONS UPON THE AVERAGE NUMBER OF REVOLUTIONS PER DAY IN THE LAST 15 DAYS OF THE PREOPERATIVE AND POSTOPERATIVE ACTIVITY TESTS

Controls (sham)			Fronto-dorsal lesions			Fronto-lateral lesions		
Rat No.	Pre-operative	Post-operative	Rat No.	Pre-operative	Post-operative	Rat No.	Pre-operative	Post-operative
4	165.7	0.2	2*	32.7	61.0	6	484.1	181.5
8	38.8	4.6	3*	79.7	115.5	7	20.6	0.7
10	1,102.0	45.0	12	913.9	96.5	17*	87.6	184.2
11*	71.4	103.1	22	27.3	5.9	23*	157.1	396.0
26	47.8	19.1	34	411.6	93.7	32	175.9	148.4
31*	74.6	81.7	40	65.5	36.7	38	211.4	47.0
Mean	250.0	42.3		255.1	68.2		189.4	159.6

*Animals which show a postoperative increase in activity.

Animals with Fronto-dorsal Lesions

Table I indicates the activity scores of animals subjected to small lesions in the dorsal surface of the frontal region. It is interesting to note that these animals practically duplicate the performance of the "sham" control group. Four of the six animals postoperatively decreased in activity while the remaining two evidenced slight increases. Activity of the group as a whole decreased 73 per cent ($P = 0.25$). In view of this similarity of performance of control and experimental animals it is quite apparent that lesions involving the dorsal surface of the frontal cortex exert no effect on activity.

Animals with Fronto-lateral Lesions

From Table I we note that the animals subjected to removal of the lateral regions of the frontal cortex showed an overall decrease in activity of about 16 per cent ($P = 0.75$). Observation of the individual performances indicates that four of them decreased in activity and two increased. Thus these animals show the same picture as the two previous groups except that the overall decrease in activity is not as great as that for the "sham" and "fronto-dorsal" groups.

Animals with Frontal "Lobectomies"

Table II records preoperative and postoperative activity scores of animals that underwent removal of all brain tissue anterior to Level 4

TABLE II

EFFECTS OF VARIOUS OPERATIONS UPON THE AVERAGE NUMBER OF REVOLUTIONS PER DAY IN THE LAST 15 DAYS OF THE PREOPERATIVE AND POSTOPERATIVE ACTIVITY TESTS

Frontal "lobectomy"			Medial (parietal) lesions			Posterior (occipital) lesions		
Rat No.	Pre-operative	Post-operative	Rat No.	Pre-operative	Post-operative	Rat No.	Pre-operative	Post-operative
1*	256.8	765.4	5*	3.3	17.3	14*	44.1	49.8
15*	27.1	236.3	9	78.6	18.4	16	81.5	78.6
20*	110.4	4,187.0	19	1,044.7	445.8	29	82.3	8.0
21*	9.5	320.7	27*	28.3	46.8	30*	32.5	38.3
			37*	67.1	75.9	35	264.9	154.1
Mean	100.9	1,377.3		244.4	120.8		101.1	65.8

*Animals which show a postoperative increase in activity.

in Lashley's diagram of the rat brain. Unfortunately two animals of this group were lost; consequently our "pre" and "post" comparisons are limited to results of four animals. Although this number is small, the results are clear. Removal of the frontal poles produces a startling increase in postoperative activity, best illustrated by Rat 20 which preoperatively averaged 110 revolutions in a 24-hour period and postoperatively recorded over 4,100 revolutions in the same period. The remaining three rats showed marked increases but not as dramatic as that of Rat 20. Animals 15 and 21 present a bit of a problem, since they were relatively inactive preoperatively (27.1 and 9.5 revolutions, respectively), so that one might argue that if any change were to occur it would, almost of necessity, have to be in the direction of an increase from this minimal score. Table III bears out this prediction, for Rats 21 and 15, the "frontal lobectomy" group, increase from 9.5 to 320.7 and from 27.1 to 236.3 revolutions respectively. The right half of Table III records the performance of seven other operated animals that were also inactive preoperatively. Of these seven rats, three demonstrate postoperative decrease, while the remaining four show some slight postoperative increases in activity. The greatest increase, shown by Rat 2, represents a rise from 32.7 to 61.0 revolutions which is considerably less than that of Rats 21 and 15. This comparison shows clearly that most of the increased activity of the "frontal lobectomy" animals is not due to the fact that these rats originally evidenced a minimum of activity and their scores could therefore be expected to increase regardless of what was done to them. The rise in activity is a very real increase.

Animals with Medial (Parietal) Lesions

The preoperative and postoperative activity scores of animals with

TABLE III

COMPARISON OF THE POSTOPERATIVE PERFORMANCE OF "FRONTAL LOBECTOMY" ANIMALS THAT WERE RELATIVELY INACTIVE PREOPERATIVELY WITH THE POSTOPERATIVE PERFORMANCE OF OTHER OPERATED ANIMALS THAT WERE ALSO INACTIVE PREOPERATIVELY

Frontal "lobectomy"			Other operations		
Rat No.	Preoperative	Postoperative	Rat No.	Preoperative	Postoperative
21*	9.5	320.7	5*	3.3	17.3
15*	27.1	236.3	7	20.6	0.7
			22	27.3	5.9
			27*	28.3	46.8
			30*	32.5	38.3
			2*	32.7	61.0
			8	38.8	4.6

*Animals which show a postoperative increase in activity.

lesions in the medial region of the cortex are presented in Table II. Of the five animals in this group, three show a small postoperative increase while the remaining two exhibit a drop in activity scores. Considering the performance of the group as a whole the postoperative activity is 51 per cent below the preoperative level ($P = 0.35$). In general, performance of this experimental group is the same as that of the previous groups with exception of the "lobectomy" cases.

Animals with Posterior (Occipital) Lesions

Table II indicates the performance of animals subjected to lesions in the posterior third of the cortex. For this group as a whole there is a 35 per cent postoperative drop in activity scores ($P = 0.25$). Examination of individual performance indicates, as in the previous groups, that some animals decrease in activity while others increase. More specifically, three animals show postoperative decreases while the other two increase.

DISCUSSION OF RESULTS

The present investigation endeavours to clarify some of the inconsistent results of studies on the role of the cerebral cortex in locomotor activity in rats. Leaving aside for the moment the performance of the control animals, the data of the experimental groups suggest that lesions placed anywhere in the cerebral cortex—whether in the anterior, medial, or posterior regions—can either increase or decrease the amount of post-operative locomotor activity. This is essentially what Beach (1) observed. However, when we look at the performance of the control animals with portions of the skull removed but with cortex left intact, we immediately note that these controls show postoperative activity changes almost

identical with those of cortically operated animals, that is, some increase in activity while others decrease. Furthermore, the magnitude of the increases or decreases of control and experimental animals is in general about the same. In view of this similarity of performance of sham and cortically operated animals we are forced to conclude that the increases or decreases in activity levels are due not to the removal of cortical tissue *per se*, but rather to such things as incision of the skin, removal of parts of the skull, possible vascular disturbances, the 25-day recuperative period given to all animals, etc. Thus it appears that the removal of cortical tissue (with the exception of frontal "lobectomy") from various parts of the cerebral cortex does not change the postoperative activity level of rats.

So far we have excluded from the discussion the effects of frontal "lobectomies." Although our sample of animals in this category is restricted to four, the results are clear-cut. All animals showed large postoperative increases in activity—increases which were much greater than those shown by any "non-lobectomy" rat. However, most of these increases were smaller than those reported by Richter and Hawkes (16), and no rat could be said to have almost run itself to death. Beach also failed to observe dramatic activity increases in his frontal animals. It should be mentioned at this point that histological examination revealed that the frontal pole removal in Rats 1 and 15 also included the tip of the corpus striatum. It is highly improbable that injury to the corpus striatum was responsible for the increased activity since Beach (2) has shown that lesions to the corpus striatum of the rat reduce rather than increase the amount of activity. Furthermore, in the two remaining animals there was no invasion of the corpus striatum, yet they showed the greatest increases of the group. The considerable increases in activity produced by removal of the frontal poles are very interesting, in view of the fact that lesions confined to either the dorsal or the lateral surfaces of the frontal region failed to have any effect on activity. This means that there is some crucial area in the frontal pole region which is not invaded by either dorsal or lateral lesions but is destroyed by a "lobectomy" type of operation producing considerable increases in activity. What this "crucial" area might be will be discussed presently.

In their investigation Richter and Hawkes reported that the frontal lesions produced a considerable increase in the irritability and savageness of their animals: "All of the rats with bilateral operations and most of the rats with unilateral operations became savage, bit at everything within reach, and made violent efforts to escape. They showed a high degree of distraction, reacting to the slightest noise, sometimes with a leap of several feet." In the present study incidental observations were

made on the emotional reactions of the operated animals at various times during a 50-day postoperative period. During the first postoperative week several of the animals would make abrupt jumps in the presence of suddenly introduced auditory stimuli or upon the introduction of the hand into the animal's cage. This "jumpiness" or increased excitability disappeared after the first week. Subsequently the animals did not differ from their preoperative emotional condition and could be handled and stroked with no signs of savageness or irritability. A number of animals chewed the walls of the cage, but this is not significant since both sham operated and cortically operated animals did so. The temporary emotional changes of the first week were undoubtedly associated with general operative shock and healing of the wound. This absence of increased postoperative savageness confirms Beach's observations and also those of Beil and Kelley (3), that no emotional disturbances were found in animals subjected to removal of varying amounts and portions of the cerebral cortex.

In interpreting the present results it might be instructive to compare them with the results obtained in animals possessing a more complex brain, especially since we may obtain some clues to what regions in the frontal cortex are responsible for the hypermotility. Two activity studies have been carried out on cats. Langworthy and Richter (13) observed that removal of one frontal pole produced a slight increase in activity. Bilateral removal, however, increased the activity level by a factor of ten. Some cats reached peaks of activity almost 100 times above their preoperative levels and a few cats, state the authors, became so active that they actually died as a result of overactivity. Smith (19) obtained essentially the same results but with somewhat less dramatic increases. Unfortunately, these two studies do not inform us whether there are any particular areas in the frontal lobe responsible for the increased activity. It is only when we come to the investigations on monkeys that we find data on the role of specific areas of the frontal lobe in activity. Figures 1A and 1B show the location of areas 8–14 which make up the dorso-lateral and orbital surfaces of the prefrontal cortex in monkeys. Richter and Hines (17), employing objective means for measuring activity, observed that bilateral removal of area 9 increased activity more than did removal of any other area, although removing areas 10, 11, and 12 produced some increase. Areas 13 and 14 were not ablated. Kennard *et al.* (10) also investigated the problem and found that separate removal of areas 8, 9, 10, 11, or 12 could produce hyperactivity, but the effect was greatest when all of the areas were ablated. Parietal and temporal lobe lesions had no effect. The time of onset of this increased activity was a variable feature, delayed for several weeks in some animals and occurring almost

immediately after operation in others. More recently Ruch and Shenkin (18) have demonstrated a very dramatic increase in activity upon removing a small region, area 13, on the orbital or undersurface of the brain. This increase is of the same magnitude as that produced by large prefontal lesions and could be detected on the first postoperative day. The interesting feature about the removal of area 13 is that there is a

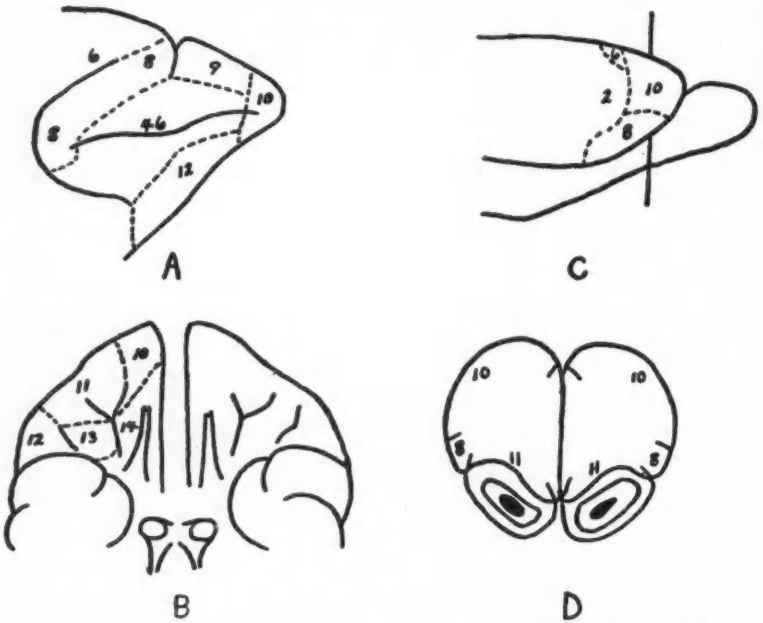

FIGURE 1. CYTOARCHITECTURAL MAPS OF THE FRONTAL "LOBES" OF THE MONKEY AND RAT

The left half of the diagram shows A. E. Walker's cytoarchitectural maps of the prefontal lobe of the monkey. The numerical designations in the maps are derived from Brodmann's designations of comparable areas in the human cerebral cortex. It is important to note that Walker's maps do not in some cases agree with Brodmann's maps for the monkey, e.g. Walker considers areas 13 and 14 as separate from area 11 whereas Brodmann includes them within area 11 (after Ruch and Shenkin, 18). Figures 1A and 1B show the lateral and the orbital (undersurface) regions of the frontal lobe, respectively.

The right half of the diagram shows Krieg's (11, 12) numerical designations of areas in the frontal cortex of the rat. These conform as much as possible to Brodmann's numerical terminology. The extent to which Krieg's areas in the rat are homologous with Walker's areas in the monkey is debatable. Figure 1C shows the lateral surface of the rat brain and Figure 1D shows a cross section through the frontal cortex at the level designated in Figure 1C (Level 3 in Lashley's map of rat brain).

qualitative change in the activity and not merely a quantitative increase as has been reported by others. The characteristic performance of the monkeys is an incessant methodical walking or pacing in a stereotyped fashion reminiscent of the pacing of a caged lion, but much faster. This incessant pacing is interrupted by periods of sluggishness and apathy. As time goes on the periods of sluggishness decrease in length and the "bouts" of pacing increase until they persist for as long as a test period of three hours. These interesting finds of Ruch and Shenkin have been recently confirmed by Livingston *et al.* (15). Thus from the above discussion it is quite evident that area 13 is perhaps of primary importance in activity, but that areas 8–12 can produce increases, especially if they are all removed.

In the light of the above studies on the role of specific frontal areas in activity let us now come back to the present experiment on the rat. The right half of Figure 1 shows Krieg's (11, 12) numerical designations of various areas in the frontal cortex of the rat. Figure 1C shows the lateral surface of the rat brain and Figure 1D shows a cross section through the frontal pole (approximately Lashley Level 3). We have previously stated that three kinds of ablations were made in the frontal cortex—fronto-dorsal, fronto-lateral, and frontal "lobectomy." Following Krieg's numerical system, the fronto-dorsal lesions would involve area 10, the fronto-lateral lesions area 8 and part of area 10, and the "lobectomy" operation would involve areas 8, 10, and area 11, an inaccessible region at the base of the brain in contact with the olfactory tracts. Since removing areas 8 or 10 was shown to have no effect, it appears that the considerable activity increase of the "lobectomy" group may have been due to the destruction of the region that Krieg calls area 11. This area would not be involved in either fronto-dorsal or fronto-lateral lesions, but would be included in a "lobectomy" type of cortical removal. This interpretation would have been given stronger support if some animals had been subjected to removal of both areas 8 and 10 to rule out the factor of mass. Although this factor was not ruled out, the fact that area 11 lies so intimately in contact with the olfactory tracts would fit in nicely with the results of monkey studies where it has been shown that removal of areas on the orbital surface near the olfactory tracts produced the greatest increases in activity. Obviously the next step is to make restricted lesions in the area 11 region and only in this region. This could quite easily be accomplished by use of a Horsley-Clarke stereotaxic instrument. It would be interesting to know whether a stereotyped performance would result. In the present investigation no stereotyped kind of performance was observed but this may have been due to the modifying effects of the additional involvement of areas 8 and 10. Furthermore, the activity

apparatus used was not conducive to observing qualitative changes in activity. Beach also did not observe any stereotyped perseverative behaviour, but again none of his lesions were restricted solely to area 11.

From the above discussion it is quite clear that hyperactivity can result from restricted lesions in the cerebral cortex but how this comes about is not too clear. A number of theories have been advanced to explain this hyperactivity. One of the early theories (9) suggested that the frontal operations render the animals more susceptible to distracting influences, increasing the amount of activity they engage in. More recently Livingston *et al.* (15) reported an increase in the temperature of the extremities of the bodies of animals subjected to area 13 removal. They suggest that this operation interferes with the animal's temperature regulation and that the hyperactivity results partly from the necessity of maintaining a normal body temperature. These "distractibility and temperature" theories fall down when it comes to explaining the stereotyped pacing behaviour of "area 13" monkeys, for there must be quite a number of other kinds of locomotor activity responses to distracting stimuli or to loss of body heat. Why should "bouts" of pacing occur rather than some other kind of activity? A favorite theory (10, 17) is that the frontal lobes exert some general inhibitory effect on cortical or subcortical structures and that upon the removal of the frontal lobes these structures are "released." Such "release of structures" leads to great increases in activity. Ruch and Shenkin regard this view as untenable, since the increase is not a generalized increase in activity but a specific one restricted to locomotor movements and not involving others, for example, head and eye movements. Furthermore, the interruption of the activity by periods of apathy indicates that the frontal cortex, although it may be exerting some specific inhibitory effects, must be exerting some other kinds of modifying effects. The final answer to the question how the quantitative and qualitative changes in activity occur must await two lines of investigation. First, anatomical and neurophysiological studies are needed to provide information on the connections of the orbito-frontal regions, especially area 13. Studies employing the technique of strychnine neuronography have already demonstrated that area 13 activates the ipsilateral and contralateral corpus striatum and also parts of the hypothalamus. More studies of this kind and also anatomical ones are needed to further elucidate the possible fiber projections of area 13. Second, behavioural studies of the role of various subcortical structures in activity are needed. A few studies of this kind have already been made. Further work on the elucidation of the mechanisms by which hyperactivity is brought about may be valuable in throwing some light on the various disorders of activity often encountered in human patients.

SUMMARY

The present study is concerned with the role of the cerebral cortex in locomotor activity in rats. The animals were tested for 25 days in revolving-drum activity cages and on the basis of their preoperative activity scores were divided into six groups, one control and five experimental groups. The control animals were sham-operated and the experimental animals subjected to removal of either the posterior, medial, or anterior parts of the cortex. The ablations involving the anterior cortex were of three kinds: fronto-dorsal, fronto-lateral, and frontal "lobectomy." All ablations were bilateral. After a 25-day period of rest the animals were returned to the activity cages and retested for 25 days. The main findings of the experiment are:

1. Removal of the frontal poles (frontal "lobectomy") produces a considerable increase in the amount of activity displayed by animals.

2. Lesions involving the fronto-dorsal, fronto-lateral, or any other region of the cerebral cortex do not affect activity.

3. The data suggest that the "crucial" area responsible for the dramatic increases in activity produced by frontal pole removals may be located in the undersurface of the brain in a region which is in intimate contact with the olfactory tracts.

4. Postoperative changes in emotional behaviour such as increased savageness which have been described by Richter and Hawkes were not found to exist.

5. Several theories about the mechanisms by which hyperactivity is produced have been discussed.

REFERENCES

1. BEACH, F. A. "Effects of Brain Lesions upon Running Activity in the Male Rat" (*Journal of Comparative Psychology*, 31, 1941, 145–78).

2. BEACH, F. A. "Effects of Lesions to Corpus Striatum upon Spontaneous Activity in the Male Rat" (*Journal of Neurophysiology*, 4, 1941, 191–5).

3. BEIL, W. C. and KELLEY, L. I. "The Effect of Cortical Lesions on Emotional and Regressive Behavior in the Rat. I. Emotional Behavior" (*Journal of Comparative Psychology*, 30, 1940, 221–38).

4. BIANCHI, L. *The Mechanism of the Brain and the Function of the Frontal Lobes* (Edinburgh: E. and S. Livingston, 1922).

5. FERRIER, D. *The Function of the Brain* (London: Smith, Elder & Co., 1876).

6. FRANZ, S. I. "On the Functions of the Cerebrum. The Frontal Lobes" (*Archives of Psychology*, 1, 1907, 1–64).

7. FULTON, J. F., JACOBSEN, C. F., and KENNARD, M. A. "A Note Concerning the Relation of the Frontal Lobes to Posture and Forced Grasping in Monkeys" (*Brain*, 55, 1932, 524–36).

8. JACOBSEN, C. F. "A Study of Cerebral Function in Learning. The Frontal Lobes" (*Journal of Comparative Neurology*, 52, 1931, 271–340).

9. JACOBSEN, C. F. *Studies of Cerebral Function in Primates* (*Comparative Psychology Monographs*, 13, 1936).

10. KENNARD, M. A., SPENCER, S., and FOUNTAIN, G. "Hyperactivity in Monkeys Following Lesions of the Frontal Lobes" (*Journal of Neurophysiology*, 4, 1941, 512–24).

11. KRIEG, W. J. S. "Accurate Placement of Minute Lesions in the Brain of the Albino Rat" (*Quarterly Bulletin, Northwestern University Medical School*, Chicago, 20, 1946, No. 2).

12. KRIEG, W. J. S. "Connections of the Cerebral Cortex. I. The Albino Rat. A. Topography of the Cortical Areas" (*Journal of Camparative Neurology*, 84, 1946, 221–75).

13. LANGWORTHY, O. R., and RICHTER, C. P. "Increases in Spontaneous Activity Produced by Frontal Lobe Lesions in Cats" (*American Journal of Physiology*, 126, 1939, 158–61).

14. LASHLEY, K. S. "Studies of Cerebral Function in Learning" (*Psychobiology*, 2, 1920, 55–136).

15. LIVINGSTON, R. B., FULTON, J. F., DELGADO, J. M. R., SACHS, E., BRENDLER, S. J., and DAVIS, G. "Stimulation and Regional Ablation of the Orbital Surface of the Frontal Lobe" (*Research Publications of the Association for Nervous and Mental Disease*, 27, 1948, 405–20).

16. RICHTER, C. P., and HAWKES, C. D. "Increased Spontaneous Activity and Food Intake Produced in Rats by Removal of the Frontal Poles of the Brain" (*Journal of Neurology and Psychiatry*, 2, 1939, 231–42).

17. RICHTER, C. P., and HINES, M. "Increased Spontaneous Activity Produced in Monkeys by Brain Lesions" (*Brain*, 61, 1938, 1–16).

18. RUCH, T. C., and SHENKIN, H. A. "The Relation of Area 13 of the Orbital Surface of the Frontal Lobe to Hyperactivity and Hyperphagia in Monkeys" (*Journal of Neurophysiology*, 6, 1943, 349–60).

19. SMITH, K. U. "Hyperactivity in the Cat after Ablation of the Frontal Lobes and its Relation to Visually Controlled Aspects of Behavior" (*Psychological Bulletin*, 39, 1942, 493).

SYSTEMS OF SHARED MEANING AS AFFECTING THE STRUCTURE OF PERSONALITY

H. W. WRIGHT

Kitchener, Ontario

It is a noteworthy fact that leading social psychologists today hold that *communication* is basic to human association, and that communication in its turn presupposes the *sharing of meanings* by inter-communicating group members.

Thus Professor Newcomb in his recent *Social Psychology* affirms that every human interaction hinges upon the communication of meaning.[1] Communication at its simplest, he says, involves the transmitting or conveying of meaning from one individual to another. For successful communication, the media employed, whether words, gestures or actions, must have the same meaning for the receiver as for the expresser, that is, refer to the same objects, persons, ideas, or what not.[2] They can thus have the same meaning for the two communicants only if perceived or understood by both of them within the same frame of reference or supplied context, determined by past experience.[3] Shared frames of reference thus make possible the accurate conveying of meaning; they provide the common understandings on the basis of which one individual can communicate with others.[4]

Frames of reference, more or less fixed, which are shared by group members, are what Newcomb calls "group norms."[5] As a social psychologist principally concerned with explaining social interaction, he views society primarily as a complex organization of positions and roles.[6] But the system, he reminds us, could not exist apart from group norms. "The role system . . . operates as a smooth running system only to the extent that group members communicate standard meanings about material objects, persons, and institutions. *Each role* within a group is *unique* in having its own position, different from all others in a role system. But *all roles* in a group have *in common* the fact that they are perceived in terms of a set of norms which make communication possible."[7] It follows, therefore, that group members share a kind of universality which two randomly selected individuals do not. It is a universality among members based on common understandings and anticipations of roles.[8]

[1]T. M. Newcomb, *Social Psychology* (New York: Dryden Press, 1950), p. 292.
[2]*Ibid.*, p. 291. [3]*Ibid.*, p. 210. [4]*Ibid.*, p. 221.
[5]Following Muzafer Sherif, and citing Sherif's significant experiment with the autokinetic phenomenon, as described by the latter in his *Psychology of Social Norms* (Harper, 1936), Chap. VI.
[6]T. H. Newcomb, *Social Psychology*, p. 277.
[7]*Ibid.*, p. 286. (Italics are the author's.) [8]*Ibid.*, p. 322.

The influence of shared norms on social interaction is not limited, Newcomb points out, to role prescriptions and role behaviour. There is, he says, a great deal of human behaviour that does not represent any particular form of role taking.[9] Associated with every institution is an ideology, a set of ideas, beliefs, knowledge, lore, which consists in part of group norms for judging behaviours related to that institution. Ideologies are thus codifications of certain kinds of group norms.[10] Shared attitudes toward the group as a common value provide the cement which holds the group together.[11] Hence, Newcomb states, "And so the 'real', sure, dependable world becomes the world as understood in terms of norms. If you can communicate about something, if you understand and are understood, then it is real."[12]

The central importance of interpersonal communication is today gaining recognition in the fields of social and abnormal psychology. What is not fully appreciated, perhaps, is the importance of shared meaning as a determining factor in all personal experience and behaviour. It is true, as the social psychologist points out, that the objects to which such shared meanings primarily refer, are material things, other people, and the actions of self and associates. But shared meanings are by no means thus limited in their objective reference. They refer not merely to people and objects and events, separately or in the aggregate, but as comprising a patterned field, an ordered world. Koffka and Lewin introduced into psychological theory the now familiar and helpful concept of the behavioural world—or the psychological field. This, the world of common perception, is certainly a realm of shared meanings. It is extended in space, hence possesses externality of existence, and yet its component objects present endlessly diverse qualities, tuned to man's powers of sensory apprehension and related to his organic needs. The objects and events of this "behavioural" world are organized teleologically, that is, with respect to man's needs and desires, and the conditions requisite to their satisfaction: some are perceived as goal-objects with positive or negative valence, others in an instrumental or steering function, as ways and means, or as signposts on the path, to goal attainment, and still others as obstacles or barriers to human satisfaction. Yet the organization of the behavioural world at the same time possesses objectivity, since the character and order ascribed to its component objects and events have been taken as guides to action, and have been verified by the survival on earth, and the increasing practical competence, of successive generations of mankind.

[9] *Ibid.*, p. 331.
[10] *Ibid.*, p. 274.
[11] *Ibid.*, p. 297.
[12] *Ibid.*, p. 292.

What has not been adequately reckoned with by psychological theory, however, is that the realm of shared meanings extends beyond the world of common perception to a far more comprehensive field which may be called the world of communicative intelligence and culture. This world of interpersonal communication is the product of the collective thinking and discussion of many generations of group members in many different tribes and nations. To this world, the stock of socially accredited knowledge, of accepted beliefs transmitted to the members of each new generation, has reference; it is the world of rational discourse. This world is not limited like the world of common perception to the familiar panorama of earth and sky and sea, perceived by, or open to the perception of, humans all over the world. It has, to be sure, an anchorage in the world of common perception, since its existence and structure are conditioned by our perception of the spoken words and the printed or written statements, records, and messages of others, along with the facial expressions, gestures, and oftentimes the actions, of fellow-communicants. The world of communicative intelligence extends beyond the limits of ordinary perception and observable existence both in *time* and in *space*. In *time*, it includes not only living persons and current happenings but also those of the historic past—political leaders and military heroes, religious founders, great artists and inventors, along with past events which have shaped the course of history. It takes in the future as well, which is planned for by the present membership of the tribe, nation, or religious organization who do what they can to insure the continued survival and prosperity of coming generations of fellow nationals or religionists. It is extended in *space* far beyond the limits of local observation and acquaintance, to include distant regions and remote places reported by travellers and explorers, all set in a geographic frame within the encompassing universe, whether of religious myth or scientific cosmology.

The world of social intelligence and culture is, furthermore, an *enduring order*, because its components are not the shifting items of sense perception but the relatively permanent kinds of objects and events, species of plants and animals, and types of relation, classified first according to their human uses, and later, with the rise of science, according to their own distinctive properties. The world of communicative intelligence is also an *organized totality*. Not only institutional activities and social techniques and roles, but also the properties attributed to natural objects, are functionally related to the values of the culture pattern which in case of the more advanced cultures includes the value of systematized knowledge. The world of rational discourse is, as well, a *logically coherent system*. If verbal symbols are to be adequate media

for the inter-communication of individual experiences, they must have, and keep, the same meaning for all communicants on all occasions. Speech forms cannot meet this requirement unless the objects they symbolize retain their own self-identical character and their relations of inclusion and exclusion, causal dependence, etc. Finally, this world possesses *objective reality*, since its character and organization are in the main confirmed by the collective observation, practical endeavours, and critical discussion of many generations of group members.

The personal-social world as thus described associates the individuals who share in the system of meanings which it constitutes. It associates them in a community far more comprehensive and far-reaching than that produced by social interaction in the world of common perception, even when this interaction is understood in terms of a system of positions and roles whose meaning is shared by all group members. At any particular time in the social history of mankind, this community has present actuality in and through the direct contact of persons who by exchange of views, joint endeavour, and emotional rapport, reach mutual understanding, if not entire agreement, about the meaning of human life and the social world. Such community, however, if on the plane of communicative intelligence, extends to take in persons of other times and places with whom it is impossible to exchange the spoken or written word, or whose ways of acting, facial expression, or significant gestures it is impossible to observe. Nevertheless, we can communicate with them, since they share with us a system of meanings through which their recorded words and remembered deeds can be understood—meanings which relate to the common intelligible world.

The sharing of meanings implies not merely that the external media of communication shall have the same or similar meaning for all communicants, but also that such communicants shall be aware, or take for granted, that the verbal or other symbols employed mean the same or have similar meaning for all. Such a sharing of meaning by communicants in different periods and times of social history would of course be quite impossible if the objective world did not possess an orderly, coherent structure which had been confirmed by the collective observation, discussion, and practical experiments of men in all times and places. So we do find thinking people of every age assuming without hesitation that classes and kinds of objects, and modes of relation, preserve their distinctive attributes, or, if they do change, change in an orderly, predictable manner. As a further accompaniment, or consequence, of the sharing of meaning with reference to the intelligible world, we also find communicants taking for granted that when they make inferences that seem valid and necessary, from objective facts which are generally

established and agreed to, their conclusions hold good for all others in the community of intelligence.

Against this background of a comprehensive and enduring world order, the individual perceives his own life as occupying a short span between birth and death, with social history stretching away for countless years backward into the past, and forward into an unknown future. Thus he views his life objectively, as he would any other event or episode in the continuing existence of earth and the history of mankind. Likewise, he thinks of the lives of all other men of all times and races as limited by the confines of mortality—and knows that his fellows view his life in the same manner. But while all communicants share the knowledge of an identical physical and social world as the background of their lives, each separate individual conceives this world in the light of his own unique experience, training, and native personal capacities. It is for each one in literal truth his own universe, different from every other person's because envisaged from a viewpoint peculiarly his own. Still, because all individuals share in the same system of objective meanings, they agree about the main features of their natural and social environment, and this measure of agreement enables them to understand and appreciate the different interpretations placed on this common world by their fellows when these are explained to them. Thus group members who are in intercommunication are able to share not only in the experience of a common social world but also in others' original interpretations and appraisals of this world. Furthermore, individuals are checked in the opinions and estimates they form of their own traits and behaviour by finding out how others with outlooks and standards more or less different from their own view these characteristics and performances. Thus communicants can attain a fair degree of objectivity, not merely in respect to the outward events of personal behaviour and life-history, but in a field where subjectivity is more difficult to overcome, that of personal traits, dispositions, and abilities.

One may wonder why shared beliefs which have been socially confirmed, concerning the terrestrial and historical frame in which social life and behaviour are set, have received so little notice from psychology. The reply might be that psychology has the task of accounting for man's actual behaviour, and that the shared beliefs in question have had little influence on his everyday interaction with his fellows and his natural environment. Religious beliefs and observances, it might be agreed, are an exception to this; they have furnished effective sanctions for the moral and social customs of the group. But religious world-views, it would be said, consist largely of creation-myths, and legends about the supernatural powers and miraculous deeds of original founders and early

teachers of the tribe and nation, which are discarded or forgotten as societies advance in the arts of civilization. Thus they might be held to be no exception to the rule that shared conceptions or beliefs regarding a comprehensive and enduring social world and cosmic order are intellectual and discursive by-products of social culture, of importance only to the few in each generation of an enquiring, contemplative turn of mind. Hence, while objective meanings of such far-reaching scope might be the legitimate concern of the philosopher, the epistemologist, or the cultural anthropologist, they have little bearing on actual, everyday human behaviour which is the dominating concern of psychology.

Against all such arguments may be set the facts (1) that a part of the task of psychology is to explain and account for the development and organization of human personality; (2) that participation by the individual in the world of intelligent and intelligible discourse plays a necessary part in the development of personality; and (3) that the structure and organization of personality cannot be understood or explained unless account be taken of those shared meanings which refer to, and have their objective counterpart in, the world of social history and cumulative culture. In substantiating these statements, it can be further shown that the essential and distinguishing features of the mature personality arise out of an interplay between the two worlds of shared meaning, (*a*) the world of common perception in which social interaction takes place, governed by a commonly understood system of positions and roles, and (*b*) the world, geographical and historical, of accepted knowledge and belief, which includes the successive generations of group members along with their contributions to the enduring culture of the tribe, the nation, or mankind.

One outstanding difference between the mature person and the biological individual is that the person can interpret his experience of people and things in the everyday world of perception and action in terms of universal, or at least long range, historic social life and achievement. Early education, supplemented by reflection upon the course of his life and the conditions which surround it, enable the individual to understand and appreciate the meaning of his work and his play, of what he does and what he suffers, of family ties, neighbourly contacts, and national service, by relating these experiences to the world of social intelligence, with its terrestrial setting and the frame it provides for the course of man's social history and the vicissitudes of his long struggle toward civilization. Religious festivals like Christmas and Easter continue to be observed partly because they remind people, otherwise preoccupied with everyday adjustment to present situations, of the inclusive cosmic background of their lives. Steps are taken by various professional groups to bring to the minds of initiates the particular forms of social service to

which their respective skills are dedicated by social tradition, their notable professional achievements in the historic past, and the signal services of founders and early practitioners.

What can thus be said about understanding objects of present perception in a context which relates them to the larger world of social culture, applies with special relevance to one class of material objects, namely, the products of social culture. The educated person perceives the words on the printed page in their potential reference to the realm of intelligible discourse, in which socially enlightened persons of every time and place can participate; he enjoys looking at pictures and listening to music because these artistic creations suggest what is universal and reconciling in human experience. Culture products embrace as well all other articles of human invention and manufacture: habitations and household appliances, industrial tools and techniques, political procedures and religious cults, modern machinery for transportation, communication, and the large-scale production of economic goods. The socially oriented person uses these products with a grateful recognition of the efforts of inventors to create something new that would be socially useful, humanly helpful, or enjoyable, and of the painstaking, protracted endeavours of their successors in later generations to improve on, perfect, and supplement these products, and an appreciation of our debt to these pioneers of human achievement.

A second characteristic distinctive of the mature person is the power he has gained of viewing himself and his life objectively, that is, as he would view any other fact or event in the real world, including of course, any other human being or human life. The basic condition for such objectivity of outlook lies, as has been pointed out, in the wider perspective which the individual gains as a member of the community of intelligence, from which he views every human life including his own as an episode in the course of time, marked off by limits of birth and death. The individual is made aware of his own characteristics and behaviour by the perceptions of everyday life. But he could not possibly view objectively the being and the life he thus perceives unless he were able to give them place in the comprehensive setting of human and world-wide history. Seen against the encompassing historical and cosmic background, his own efforts and achievements, no matter how impressive at short range, seem puny and insignificant. He may well be amused at the contrast between the sum-total of his life's influence (or that of the ablest, most productive human beings) and the power of the vast forces operative in the evolution of this planet and the forms of life upon it.[13]

[13]As pointed out with emphasis, by G. W. Allport, *Personality* (Henry Holt and Company, 1937), p. 222.

Still, he may in fairness remind himself that his own intelligence is capable of taking the universal point of view, and thus of identifying him with the enduring world system rather than with a transient collection of protoplasmic cells within this system.

A third characteristic which distinguishes the mature personality is the capacity for inter-personal association of the most fruitful and satisfying type. Inter-personal association varies in kind according to its source in the lives and behaviour of those concerned. It may be based on mutual convenience, practical advantage, economic gain. Or it may spring mainly from the pleasure which two or more people take in the presence and talk, the looks and the ways, of each other. But the most fruitful and satisfying kind is based primarily on intelligent communication—the free exchange of ideas and opinions, information and belief, purposes and ideals, through talk and discussion often renewed and vitalized by the perceptual presence and expressive movements of the participants. Such inter-personal communication is possible, as we have seen, because the participants as members of the community of intelligence share in the same system of meanings which refer not merely to the world of common perception but also to the more comprehensive world of social history and culture. But it derives inexhaustible interest and potentialities for satisfaction from the further fact that each communicant surveys and evaluates this world from a unique point of view produced by his own individual talents, experience, and training. Yet because all share the same world of rational discourse, each is able, within wide limits, to communicate to others what is original and unique in his world outlook, which they on their part can understand and by sympathetic imagination realize—to the enrichment of their own personal experience. There is bound to result a progressive mutual disclosure and understanding of personal differences in ways of thinking, in practical ingenuity and resourcefulness, and in emotional-imaginative appreciation, of the significance of life and the world. Disclosures among these varied lines, always inter-connected and inter-penetrating, coalesce into a revelation of the unique personal character and experience of each to the other.

The distinguishing marks of mature personality thus far mentioned are manifested in the fields of perception, understanding, and imagination. But man is not only observer and thinker. If he is to survive, he must act. To external stimulus-situations as they arise, he must respond by taking advantage of what possibilities of adaptive action they present. We have next to notice that, in the field of action as well as that of thought, the development of personality depends upon the inter-relation between the two worlds of shared meaning in which human individuals participate.

It has been stated that the comprehensive world of social intelligence and culture envisages, besides the present and the historic past, an extended future in which succeeding generations of family descendants, fellow nationals, or mankind, are expected to live on and to continue their practical efforts to utilize more effectively the resources of earth and of the human organism in the attainment of security and happiness. Now the constructive intelligence of the human being whose horizons have been thus extended beyond the limits of his present situation and even of his natural lifetime will descry in the forces and materials of nature, both physical and human, possibilities of contributing to the continuing social culture of his people and of humanity. Some of these possibilities he may attempt to realize, by employing powers of practical contrivance and invention which he has acquired in the course of his perceptual-motor contacts with the external world, in order to devise new and improved techniques for promoting these interests, domestic, industrial, political, which are vital to organized human society in all times and places. So far as he does this, the individual is able within the limits of a natural lifetime, to make an original and lasting contribution to social progress which gives him a permanent place in the community of associated intelligence.

When the individual person thus undertakes to realize social goals that are inclusive and far-reaching, a further consequence follows of utmost importance to personal growth. Among associates in the give and take of social interaction, with interests discrepant, if not competing with his own, it is likely that he will discover some who have purposes and loyalties similar to the ones he cherishes. Such community of purpose engenders a readiness to co-operate with all others who are working to realize the same or allied social goals. While manifested in many fields of inter-personal relationship, such co-operation is most effectively displayed in the field of vocational or professional endeavour. The common purpose which sustains co-operative effort may extend beyond the supplying of useful commodities and services, to the improvement of methods and techniques which represent a lasting contribution to social betterment. The collective activity of such a group may exhibit the very highest degree of co-operation in which each participant employs his original powers of practical invention and execution in serving the purpose of the operative organization, and derives full measure of personal satisfaction from its concerted achievements.

The intelligible world of social history and culture with its cosmic setting has yet another claim on the attention of psychologists. Not only is it responsible, through its relation to the world of common perception, for distinctive characteristics of the developed personality; it is also the source of those personal values whose pursuit and realization by

human individuals associates them on the highest plane of human attainment. The values in question are not subjective in the sense of depending on individual liking or preference. Neither are they relative to the survival, prosperity, and prestige of any social group, which may be sought as goals by its members. Rather, they are properly termed objective, because they are based on relations which exist among objects of the real world—relations which create possibilities of attainment that appeal to human intelligence. The first relation is that of coherence of character and mutual implication, which makes objects intelligible. The second relation of joint efficacy makes the forces and materials of existing nature functionally adaptable, and capable of being combined into complex dynamic systems. The third relation of patterned harmony among visual and auditory qualities of existing objects gives them symbolic significance. These objective relations, with the possibilities they create of knowledge, of practical power and control, and of aesthetic perception, evoke affective-volitional responses from the intelligent individual. The knowableness of existing objects appeals to his intellectual curiosity, their joint efficacy appeals to his powers of practical contrivance and invention, and their significant sensuous harmonies appeal to his capacity for aesthetic appreciation and enjoyment. There is no doubt that such responsiveness to the values of scientific knowledge, practical power, and beauty, is a distinctive mark of maturity of personality.

Modern psychology has called attention to a feature of these three responses of systematic thought, practical invention, and aesthetic perception, which has largely been ignored by philosophical students of human nature in the past, but which bears directly on the part they play in personal development and association. This is that the responses in question involve and depend on bodily movements in the outer world which are observable, and in many cases actually observed, by others. Systematic thought exercises the motor mechanisms of articulate speech, spoken and written, whose differentiated and conventionalized patterns enable the thinker to maintain the continuity of his own thinking and to ascertain its consistency with the accumulated stock of human knowledge. Practical contrivance and inventive construction in a parallel fashion involve and rely on motor manipulation and adjustment. The imagination of the inventor of tools, technical methods, and machines may require for its fruitful exercise only incipient, invisible manipulatory responses, but the realization and proof of his invention depend on processes of external construction. It should be noted, moreover, that man's powers of practical contrivance and invention deal not merely with the forces and materials of the physical world but with living beings as well, in the culture of plants and animals, and also with the behaviour tendencies of

humans, in devising new and more efficient procedures of social regulation and political administration. Similarly, aesthetic perception is accompanied and conditioned by sense-organ adjustments, by changes in bodily attitude and posture, and by those emotionally expressive movements, whether of the facial muscles or vocal organs, or of dumb-show or dramatic portrayal, or of rhythmic step and patterned movement, which are the source and beginning of artistic creation.

The fact that as much realization of the objective values of truth and power and beauty as is open to man can be achieved only by a type of response which involves bodily movement has consequences of great moment for human personality. It means that the possibilities of knowledge, of power over the forces of the physical and the animate world, and of beauty in nature and in art, cannot be envisaged and realized without being at the same time externally embodied and expressed. And when they are given external, physical embodiment in vocal sounds and written characters, in manual contrivances and emotionally expressive patterns of colour and form and sound and movement, they are made communicable—are in fact communicated, more or less fully of course, to all observers who through these external instrumentalities share in the same world of intelligible meaning. There follows from this a consequence of far-reaching import for personal development and social progress. These values are sought and realized directly and at first hand by the comparatively few gifted individuals in any generation of mankind—thinkers, inventors, artists. But they can be realized by others, indirectly and by communication. Culture products, consisting of oral traditions and accumulated writings, industrial tools, methods and appliances, social and political procedures, and creations of fine art, express and perpetuate through material embodiment the achievements of creative minds in successive generations. All group members who gain insight into the meaning of these culture products share in the realization of the objective values they express and communicate. These two methods of realization are not mutually exclusive alternatives, however. The progressive realization of these values by any social group is brought about through an interplay between communication and some degree of original contribution on the part of every component personality.

The three values we are considering, inherent in the cosmic world of intelligible meaning, make still another contribution to the growth and fulfilment of human personality—a contribution of very great significance for those whom it affects directly, and through their instrumentality and influence, for all mankind. The pursuit of any one of these goals, whether in the intellectual, technological, or aesthetic field associates those engaged in it in an especially complete and satisfying form of co-operation.

It is obviously true that advancement of knowledge, of technical efficiency, or of aesthetic enjoyment, is sought as a dominant life-goal by a comparatively small fraction of mankind. But the co-operation induced and fostered by any one of these values is not limited to fellow workers among the living, but extends to include predecessors in all past times who have made lasting contributions to its attainment. The seeker after scientific truth in any field co-operates with fellow enquirers of his own time, with some by direct acquaintance and everyday association and with others indirectly through their published writings. But if his quest is seriously undertaken, he will be drawn into helpful communication with thinkers of past ages; by a study of their writings he will be enabled to understand their views, appreciate and build on their discoveries, and to receive fruitful suggestions to guide his own constructive thinking. Likewise in the field of invention, mechanical and social, the inventor of any age starts with the stock of technological inventions which have been handed down from past ages, and so far as he makes use of them, will participate in the imaginative insights of their originators as to the means by which the forces and materials made available by nature can be effectually isolated and controlled and combined to rational social uses. In the aesthetic field also, musicians and poets, painters and sculptors and architects work under the inspiring example and tutelage of the great masters of the past with whom they communicate through the symbolism of their art. Furthermore, the values in question can be sought and attained only by communication and co-operation. The pursuit of goals like wealth and fame is inevitably competitive, since the quantity of material wealth and social honors is limited and what one man obtains and enjoys others have to do without. But increased knowledge, technological progress, and the creation of beauty can be achieved in no other way than by the communication and co-operation of fellow-workers who share their aims, their problems, their methods, and their results. In their case, whatever the individual achieves for himself is equally helpful to his colleagues, and by their successes, whether through individual initiative or the pooling of effort, he is likewise a gainer.

Summary

The structure of human personality is dependent upon an inter-relation between two worlds of shared meaning, namely, the world of common perception and the world of communicative intelligence and social culture. Such inter-relation makes possible human personality as we know it, and accounts for the distinctive features of the developed personality.

The mature person can and does interpret his everyday experiences of the world of present perception and social interaction in the light of their

setting in the comprehensive world of man's social history with its cosmic background. He is able to view the course of his natural existence in relation to the biological laws which govern the birth, growth, senescence, and death of all living beings in all times and places. He can understand his own traits and abilities as the product of factors, hereditary and environmental, which account for the components of human individuality everywhere, and can rate them fairly in comparison with those of men of different endowment and upbringing. Thus he learns to view his own life-history and personal character objectively. Another characteristic of the developed personality is the power it gives to the individual possessing it of conveying to others such interpretations and appraisals of human life and the world as he has arrived at from the unique vantage point of his own experience and attainments, and of understanding and appreciating the original views and viewpoints of others when they are communicated to him. Thus he is able to enrich his own personal experience by comprehending the unique outlooks of many other individuals on the common world, and taking account of their estimates of his personal qualities, abilities, and achievements. Again, the mature person with his extended vision of centuries of social history to come will be interested in the use that can be made of the agencies available in the world as he perceives it to improve the condition and prospects of future generations of mankind, and will be ready to employ his practical skills to aid in such social projects in co-operation with others who have a similar concern for the future progress of humanity. Finally, it is a mark of the well-developed personality to respond to the appeal which the existing universe of physical nature and human experience makes to the intellectual curiosity, the mechanical and social inventiveness, and the aesthetic perception of man, and to participate to some extent in the advancement of knowledge, the practical adaptation of physical forces and biological tendencies to rational social uses, and in the creation and enjoyment of beauty in nature and the products of fine art.

THE DEPENDENCE OF BINOCULAR FUSION ON TIMING OF PERIPHERAL STIMULI AND ON CENTRAL PROCESS

1. Symmetrical Flicker (*continued*)

C. H. BAKER
*University of Toronto**

THIS IS the continuation and conclusion of Part 1 of a series of papers which hypothesize that central physiological processes are a factor in effecting binocular fusion. An earlier paper (1) pointed up the problem and method, and presented Experiment 1. It was concluded from this experiment that binocular fusion involves, in part at least, some central process which combines and integrates the neural processes arising from stimulation of corresponding retinal points, so that the resultant sensation differs from that arising from either eye alone.

EXPERIMENT 2

This experiment was a modification of Experiment 1. The two bottom ("progressive") neon apertures were employed, thus providing an orange-red stimulus rather than the white which was employed in Experiment 1. These apertures subtended a visual angle of 2 degrees. Sector cut-off was again across corresponding retinal points, but in this case the sectors progressively occluded the stimulus patch from top to bottom; that is, they provided a homovertical rather than a homolateral cut-off. One further difference was that artificial pupils were not employed. This modification was attempted because, as Zoethout (11, p. 120) has pointed out, when the eye has become thoroughly adapted to a certain brightness the pupil "has obtained a fixed diameter—the physiological pupil width." Also, Knox (8) reports no difference between rates for eyes with or without artificial pupils. Readings were taken at each of three brightness levels, namely 8, 5.5, and 3 foot-lamberts.

Subjects binocularly combined the two horizontally aligned neon apertures which, in binocular combination, appeared as a single orange-red aperture divided into quadrants by a delicate black cross. The method of successive comparison was again employed. (This successive comparison method was favoured in the rest of these experiments, also, because it is known (2, 4, 5, 6) that a stimulus applied to one retinal area modifies the critical flicker frequency of an intermittent stimulus to another. As the method of simultaneous comparison was employed by Sherrington (9), and in effect in Experiment 1, it is improbable that the readings obtained were as accurate, in an absolute sense, as they could be.) Monocular readings, right eye only, were again taken.

*The author is now with the Defence Research Board, Defence Research Medical Laboratories, 1107 Avenue Road, Toronto, Ontario.

Results. The results of Experiment 2 are graphically shown in Figure 1. The differences between the synchronous-monocular, and between the monocular-alternate conditions are all statistically significant. (Two differences are significant at the .02 level of probability, fifteen at the .01 level, and thirteen at the .001 level.)

Conclusion. Evidence was again obtained of a central process being involved in binocular fusion. This process is active when the visual stimulus is of a red-orange hue as well as when it is white. It can be demonstrated, too, when artificial pupils are not employed. Finally, its activity can be demonstrated when corresponding retinal points are occluded in a vertical rather than in a homolateral direction.

Experiment 3

Experiment 3 was a duplicate of Experiment 2 with the exception that a 53-minute neon stimulus field was employed instead of a 2-degree field. (Hartridge (7, p. 16) finds that a foveal area subtending a visual angle of more than 53 minutes possesses rods as well as cones.)

Each subject, upon attaining the required degree of adaptation to dark, was first exposed to the 2-degree neon field (Experiment 2), and six readings were taken to ensure that there were no gross differences between critical-flicker frequencies for the 2-degree field in these two experimental sessions a few days apart. The 53-minute field was then substituted for the 2-degree field, and the readings were taken as for Experiment 2, at each of three brightness levels. Sector occlusion was in a homovertical direction.

Results. The results of Experiment 3 are graphically shown in Figure 2. They are very similar to those of Experiment 2, except that all critical frequencies are about 10 per cent lower. The differences between the synchronous-monocular, and between the monocular-alternate conditions are all statistically significant. (Seven differences are significant at the .01 level of probability, and twenty-three at the .001 level.)

Conclusion. By progressively occluding a 53-minute neon vision field in a homovertical direction (across corresponding retinal points), evidence was again obtained of a central process being involved in binocular fusion.

Experiment 4

Like Experiment 3, this experiment was a duplicate of Experiment 2 with the exception that a 38-minute stimulus field was employed instead of either a 2-degree or a 53-minute field. This size of field was arbitrarily chosen as being sufficiently smaller than the 53-minute field to point up any differences in critical-flicker frequency resulting from differences in

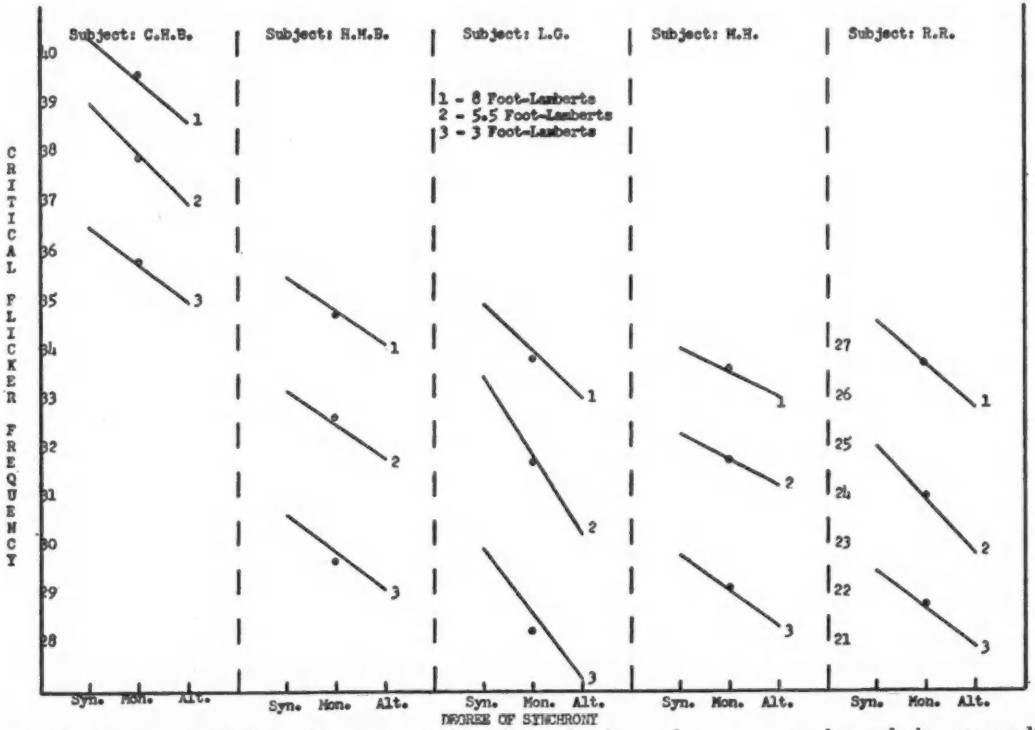

FIGURE 1. Showing the critical flicker frequencies of five subjects for the synchronous, monocular, and alternate conditions at each of three brightness levels.

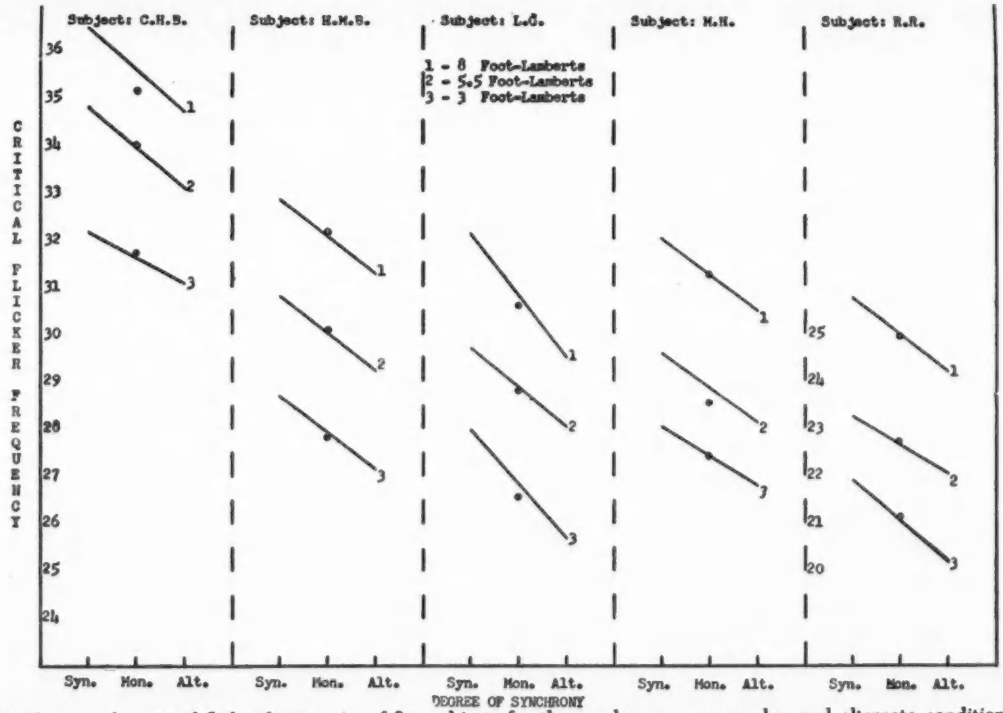

FIGURE 2. Showing the critical flicker frequencies of five subjects for the synchronous, monocular, and alternate conditions at each of three brightness levels.

retinal areas stimulated, and at the same time to be large enough to be easily observed by subjects.

Results. The results of Experiment 4, when graphed, are very similar to those of Experiment 2, except that all critical frequencies are about 15 per cent lower. The differences between the synchronous-monocular, and between the monocular-alternate conditions are all statistically significant. (Fourteen differences are significant at the .01 level of probability and sixteen at the .001 level.)

Conclusion. By progressively occluding a 38-minute vision field in a homovertical direction (across corresponding retinal points), evidence was again obtained of a central process being involved in binocular fusion.

Experiment 5

Experiment 5 was a duplicate of Experiment 3 with the exception of the direction of occlusion of the stimulus field. Sector cut-off was in a homolateral direction (as for Sherrington (9) and as in Experiment 1) rather than in a vertical direction as in Experiments 2, 3, and 4.

Results. The results of Experiment 5, when graphed, are very similar to those of Experiment 3. The differences between the synchronous-monocular, and between the monocular-alternate conditions are all statistically significant. (Eight differences are significant at the .01 level of probability and twenty-two are significant at the .001 level.)

Conclusion. By progressively occluding a 53-minute neon vision field in a homolateral direction (across corresponding retinal points), evidence was again obtained of a central process being involved in binocular fusion.

Experiment 6

This experiment was a duplicate of Experiments 5 and 3 with the exception of the direction of occlusion of the stimulus field. The direction of stimulus occlusion in this experiment was in a heterolateral direction, or across non-corresponding points. Not only were the simultaneously occluded or illuminated retinal points of a non-corresponding nature, but they were in exact diametric opposition to one another (if the two retinae can be considered, for a moment, as physically superimposed, so that the corresponding points coincide).

This experiment, then, is the first of this series to occlude retinal points of the respective eyes which stand in a non-corresponding relation to one another.

Results. The results of Experiment 6, when graphed, are very similar to those of Experiment 3. The differences between the synchronous-

monocular, and between the monocular-alternate conditions are all statistically significant. (Two differences are significant at the .02 level of probability, fourteen at the .01 level, and fourteen at the .001 level.)

Conclusion. By progressively occluding the monocular components of a 53-minute vision field in a heterolateral direction (across non-corresponding retinal points), evidence was again obtained of a central process being involved in binocular fusion.

Experiment 7

Experiment 7 was a duplicate of Experiment 6 (and of Experiments 5 and 3) with the exception of the direction of occlusion of the stimulus field. In this experiment the sector occlusion was in a heterovertical direction; that is, one component was vertically occluded from top to bottom and the other from bottom to top. The direction of occlusion, then, was again such as to simultaneously occlude or illuminate non-corresponding retinal points.

Results. The results of Experiment 7, when graphed, are very similar to those of Experiment 3. The differences between the synchronous-monocular, and between the monocular-alternate conditions are all statistically significant. (Two differences are significant at the .02 level of probability, six at the .01 level, and twenty-two at the .001 level.)

Conclusion. By progressively occluding the monocular components of a 53-minute vision field in a heterovertical direction (across non-corresponding retinal points), evidence was again obtained of a central process being involved in binocular fusion.

Discussion (Part 1)

Each of the seven experiments outlined above has provided positive evidence for the hypothesis concerned; that is, that the synthesis of the right and left monocular images into a binocular percept is brought about, in part at least, by a central process, and is not wholly a "psychic synthesis."

Sherrington (10) was able to demonstrate allied and antagonistic reflexes in the motor side of the nervous system; in our experiments a principle, similar in kind if not in degree, has been demonstrated in the sensory side of the nervous system. Intermittent visual stimuli which are symmetrical in nature (of equal bright and dark phases), and synchronously timed, reinforce one another in sensation (are in alliance), so that the binocular percept of flicker fusion is achieved at a significantly greater rate of stimulus intermittence than that required for either eye alone. Similarly, stimuli which are timed exactly alternately, mutually reduce one another in sensation (are antagonistic), so that the binocular

percept of flicker fusion is achieved at a significantly lower rate of stimulus intermittence than that required for either eye alone.

Sherrington's concept of "the final common path" is of interest here because it might be employed as an explanatory principle of the results obtained above. He says: "That portion of the synaptic system which is termed 'central' is the portion where the nervous paths from the various peripheral organs meet and establish paths in common, i.e. common paths. It is therefore in accord with expectation that we find the organ in which this meeting occurs situated fairly midway among them all, i.e. centrally" (10, p. 312).

When one considers the anatomical nature of the optic apparatus, and the results found in the experiments above, one recognizes that a final common path is not only a possibility but a distinct probability in the sensory side of the nervous system. Indeed, Carr (3, pp. 159–244) evidently takes it for granted. The central process referred to in the hypothesis above, then, would be synonymous with the unique activities of such a path.

What is its nature? Where is it located? These questions will be faced in a later discussion. But one thing is known now. Such a path cannot consist simply of optic neural fibres from one retina which, somewhere in the brain, synapse with fibres from the corresponding points of the other retina to result in single vision. For the evidence from the experiments above indicates, plainly and firmly, that the monocular images which give rise to binocular products show similar alliance and antagonism (depending on the timing conditions), whether they are the result of stimulation of *corresponding* or of *non-corresponding retinal points.*

Comparison of Foveal Areas Stimulated

Experiments 2, 3, and 4 were undertaken to determine whether the main hypothesis can be sustained regardless of the foveal area stimulated. The results indicate that it can. A secondary feature of these results is that critical flicker frequency varies with the size of the foveal area stimulated. It has long been known (2, p. 126) that critical flicker frequency increases as the size of the retinal area stimulated is increased from the fovea into the peripheral retina in ever widening circles. But to the best of this writer's knowledge no studies have been concerned with this relation within the fovea only.

Conclusions (Part 1)

1. Binocular fusion involves, in part at least, some central process which combines and integrates the neural processes arising from stimulation of similarly sized retinal areas (whether corresponding or not), so

that the resultant binocular percept differs from that arising from stimulation of either eye alone.

2. The central process involved in binocular fusion is demonstrable over a considerable range of stimuli brightnesses, and for at least two different stimulus hues.

3. The central process can be demonstrated regardless of the size of the foveal area stimulated.

4. The central process can be demonstrated with and without artificial pupils.

5. Within the fovea critical flicker frequency varies with the size of the foveal area stimulated.

REFERENCES

1. Baker, C. H. "The Dependence of Binocular Fusion on Timing of Peripheral Stimuli and on Central Process. 1. Symmetrical Flicker" (*Canadian Journal of Psychology*, 6, 1952, 1-10).

2. Bartley, S. H. *Vision* (New York: D. Van Nostrand, 1941).

3. Carr, H. A. *An Introduction to Space Perception* (New York: Longmans Green, 1935).

4. Fry, G. A. and Bartley, S. H. "The Effect of Steady Stimulation of One Part of the Retina Upon the Critical Frequency in Another" (*Journal of Experimental Psychology*, 19, 1936, 351–6).

5. Granit, R. "Comparative Studies Upon the Peripheral and Central Retina. 1. On Interaction Between Distant Areas in the Human Eye" (*American Journal of Physiology*, 94, 1930, 41–50).

6. Granit, R., and Davis, W. A. "Comparative Studies Upon the Peripheral and Central Retina. IV. Temporal Summation of Subliminal Visual Stimuli and the Time Course of the Excitatory After-Effect" (*American Journal of Physiology*, 98, 1931, 644–53).

7. Hartridge, H. *Recent Advances in the Physiology of Vision* (London: J. A. Churchill, 1950).

8. Knox, G. W. "The Relation of Dynamic Factors to Flicker and Fusion" (*Abstracts of Doctoral Dissertations of Ohio State University*, 35, 1941, 67–74).

9. Sherrington, C. S. "On Binocular Flicker and the Correlation of Activity of 'Corresponding' Retinal Points" (*British Journal of Psychology*, 1, 1904–5, 26–60).

10. Sherrington, C. S. *The Integrative Action of the Nervous System*, 2nd edition (New Haven: Yale University Press, 1947).

11. Zoethout, W. D. *Physiological Optics* (Chicago: Professional Press, 1947).

A STUDY OF THE EXISTENCE OF CERTAIN PREJUDICES IN THE MIDDLE YEARS OF THE ADULT[1]

WAINWRIGHT D. BLAKE
Bucknell University, Lewisburg, Pa.

The Problem

The problem with which this study is concerned relates to the degree of the existence of certain prejudices among adults of the middle years (35–65). The prejudices to be considered in this study are with regard to: swearing by men; swearing by women; drinking by men; drinking by women; smoking by men; smoking by women; the Hebrew; and the Negro. Only prejudices "against" are to be used.

The Subjects

Data were obtained from 157 adults, 103 males and 54 females. No criterion was set up beyond the requirement of age between 35 and 65 years.

The Procedure

The data were collected by members of the seminar group in the course on Psychology of Maturity and Later Maturity at Bucknell University in a random survey of the field of adults. They were obtained by personal contact with the 157 individuals used in the study.

When all the data were in, they were organized into three groups or categories for greater ease in examination. These groups were on the basis of sex and age separately, and sex and age together.

In each of the three categories, the number of individuals registering the existence of a prejudice in each of the seven areas considered was noted. Totals were obtained and the percentages calculated.

Results

Since the amount of data obtained and used is small, no attempt can be made to draw very exact conclusions. Certain tendencies, however, may be inferred by an examination of the following facts drawn from the data. Certain comments relative to these inferences may be made.

1. Women do not like to hear men swear and emphasize it by indicating their disapproval by a two to one percentage. The older women very strongly disapprove.

Comment. Disapproval by older women seems to show that these older people, being conditioned to what is called "Victoria Era" behaviour, are unable to get away from it (assuming they wanted to).

[1]Abstract of paper read at the annual meeting of the Canadian Psychological Association, London, Ontario, May 28–30, 1951.

2. Swearing by women is emphatically disapproved of by nearly all those interviewed.

Comment. The general feeling regarding women swearing again seems to indicate the effect of early influences which do not change too much as the individual grows in years.

3. Drinking by men was disapproved of by more women than men and by younger men more than by their elders.

Comment. The fact that younger men disapprove of the male of the species drinking may indicate that the young have an idealistic outlook on the future and do not, as the older males seem to do, feel disillusionment. Early attitudes against drinking apparently were not strong in the older men, or, because they wanted to use alcoholic beverages themselves, they modified their earlier attitudes.

4. Two-thirds of those interviewed strongly disapproved of drinking by women.

Comment. As indicated by the response to swearing, the strong disapproval of women drinking is evidence of the existence of an attitude developed in an earlier day which is apparently still unmodified.

5. The younger males were more opposed to women smoking than were the younger women. The older individuals of both sexes were more opposed than the younger.

Comment. The influence of pre-adult conditioning in the acceptable behaviour of an earlier day is seen in the dislike older people feel of seeing women smoking.

6. There was no great difference between the sexes in feeling against Hebrews. More prejudice seemed to be felt by the older group than the younger.

Comment. Possibly the prejudices existing in the older groups against Hebrews stem from a longer experience in competitive activities with them which reinforce an earlier adult-induced attitude. On the other hand, the younger groups have not, as yet, experienced competition with Hebrews, nor are they as likely to, since the multiplicity of jobs and of kinds of jobs widens the choice of work for each individual. Apparently, too, there is less emphasis on these things in the home.

7. There seems to be very little difference between the sexes with respect to prejudice against the Negro. The younger group apparently has considerably more prejudice than the older group.

Comment. The apparent rise in prejudice among the younger group against the Negro may be caused by at least two factors: competition in industry, and constant agitation on "rights and privileges" in the past several years which may, as is often the case, have backfired.

There are other comments which may be made relative to the findings

of the study. It does, however, seem to show that prejudice in the areas checked does exist and in many instances seems to be a result of early conditioning which still clings to the individual in later life. That seems to be the present situation. If we don't like it, possibly a long-term educational programme, carried on without parade and fanfare, will eventually result in a less violent set of attitudes.

Twenty-five Years of Child Study—The Development of the Programme and Review of the Research at the Institute of Child Study, University of Toronto, 1926–1951. By the STAFF OF THE INSTITUTE. Toronto: University of Toronto Press, 1951. Pp. xiii, 182. $4.00.

IN THE HISTORY of the development of Canadian culture, the year 1951 is likely to stand out as one in which large numbers of Canadians came to a conscious realization that their national culture was uniquely Canadian and not merely a pale imitation of or even a mixture of the cultures of Great Britain and the United States.

This new awareness of their own culture on the part of Canadians was the result of several factors. One was that certain happenings in the United States made a host of ordinary Canadians realize that their own way of responding to such events would have been quite different from that of the Americans. Then, too, the publication of the report of the Massey Commission on the Arts, Letters and Sciences, and the fact that a Commission report became a best-seller, indicated a ripening self-consciousness of Canadians with respect to their own uniqueness as a nation. Among other significant factors may be listed the publication of *Twenty-Five Years of Child Study*—a volume which made a large number of Canadians aware, for the first time, of a unique Canadian contribution to the development of research in child study, of nursery schools, of parent-education, and of the training of skilled teachers in the field of pre-school education.

The book was prepared by the staff of the Institute of Child Study of the University of Toronto and presented to the Director, Dr. W. E. Blatz, as a tribute to his dynamic leadership during the twenty-five years of the Institute's existence.

That Dr. Blatz richly deserves such recognition will be freely admitted by all those Canadians who have been working in the fields of psychology, education, and mental hygiene—even by those who have, from time to time, felt bound to disagree with Blatzian ideas and methods. Dr. Blatz has brought to his work a freshness and vigour of thought which, combined with his devotion to the scientific methods of study and his dynamic personality, were bound to result in challenging achievement. Members of the Canadian Psychological Association will unite in congratulating Dr. Blatz on the publication of a book which is intended as a tribute to his leadership and scholarship.

The various sections of the book deal with the historical development of the Institute and the four main aspects of its work—the research programme in child development, the demonstration programme in nursery education, the community leadership in a parent-education programme,

and the training of skilled workers in both nursery school and parent-education. The carrying out of any one of these aspects of its work would have been a notable achievement on the part of the Institute. However, the unique contribution of the Institute has been that these four aspects of its programme were at all times interlocked. All the workers in each of the four aspects of the programme participated to some degree in the other aspects. As a result, there was at all points a very profitable cross-fertilization of theory and practice. Indeed, the success of the Institute seems to have been due in considerable degree to the fact that it was from the first an inter-disciplinary venture in which various departments of the University—psychology, psychiatry, education, nursing, etc., each had a share.

There is no doubt but that the work of the Institute has had a very great influence in this country and beyond on the study of the pre-school child and the development of nursery schools. Dr. Blatz and his associates, starting from a mental hygiene point of view, have developed over the years a philosophy of pre-school education which has had far-reaching effects. It is a child-centred philosophy which considers the child's experiences first and cultural expectations second.

In the work of the nursery school of the Institute the Blatzian conception of development was the cornerstone. The child was considered to be above all else one who learns and the goal of the nursery school was to evolve a way of guiding his learning. Since the child's day was made up of a combination of routine and play periods, the Institute set out to discover what these could mean in the child's learning and development. As a result of its study, the point of view developed that consistency of routine programme was maintained in order that the child would attain an efficient, fully satisfying habit. This would provide experience in self-dependence and responsibility as well as in security for the child—the latter an important Blatzian concept.

The Institute also gradually developed in its nursery school a philosophy of the place of play in the child's development—both play with things and play with other children. In play with things the child was encouraged to choose his own material and to decide what he should do with it. The adult's role was one of interest but limited interference. In the child's social learning through play with other children, the role of the adult was that of adviser and arbitrator, with a view to simplifying and clarifying the learning situation for the child.

In the Institute, emotional control and expression were viewed as problems of learning. Emotions of fear and anger were considered to be symptoms of difficulty in the child's life—when he was unable to meet his inner needs or to handle the problems he encountered.

The book describes how the above philosophy has led to an increasing emphasis on "discipline." By this the Institute means that the child should learn willingly to conform to certain goals and procedures, not by being forced or frightened into doing so but by guidance into discovering the value of conformity, so that he chooses to conform willingly. In addition, however, the child must learn the "art of non-conformity"—that is, the art of creative endeavour in which he is encouraged to believe in himself. The adult's role here is actively to encourage independence and not merely remain in the background when the child puts forth efforts to create and to explore his world.

The activities of the Institute in parent-education are described somewhat briefly in the book. These consist first of all of study groups composed of parents of nursery school children and of other parents in the community. In addition the Institute trains professional leaders in parent-education through its Diploma Course, as well as lay leaders.

Considerably over half the book is devoted to the research activities of the Institute. First a general overview is given of the growth of the research programme and its various aspects of development. Then follow abstracts of the various research studies. Those who planned the book had the good judgment to avoid merely picking out the most brilliant of these. Instead all have been included. This is valuable since it enables readers to follow the threads of thinking as the work of the Institute developed.

The book seems to the reviewer to be especially valuable because it brings to professional workers in the fields of medicine, social work, nursing, and education, as well as to educated laymen, an excellent overview of an outstanding Canadian attempt to apply the scientific method to the study of child development, and at the same time to test out research findings in the day-by-day work of the nursery school and in the study groups in the field of parent-education.

S. R. Laycock

University of Saskatchewan

Editor's Note: *The Bulletin of the Institute of Child Study* offers the best means of keeping informed on the Institute's activities and on the philosophy of its staff in the fields of child study and parent education. It is published under the joint editorship of Dr. Karl S. Bernhardt and Dr. Mary Northway. The leading article is usually from the pen of the Director of the Institute, and the other staff members contribute most of the remaining material. In the March 1952 issue, the Bulletin began its fourteenth year of publication in an attractive new format. It is issued as

a quarterly and the subscription price is $1.00 a year. Sample copies are available on request from the Institute, 98 St. George Street, Toronto.

The Lonely Crowd, A Study of the Changing American Character. By David Riesman, in collaboration with Reuel Denny and Nathan Glazer. Toronto: Ryerson Press, 1950. Pp. xxvii, 386. $5.25.

In this social psychological study, Riesman formulates the impact of social change upon the individual in terms of the development of certain "social character" types. "Social character" is defined as "the patterned uniformities of learned response that distinguish men of different regions, eras, and groups."

Riesman delineates three major modes of social control and corresponding character types, whose emergence is related to the degree to which scientific knowledge and industrialization have influenced population growth in a society: (1) *Tradition direction* is the method of insuring social conformity in the primitive society of high birth rate and equally high death rate. (2) "*Inner-direction*" refers to the tendency to early acquisition of an internalized set of goals, this method of character-conformity being predominant in the industrializing society where the death rate is being rapidly reduced. (3) "*Other-direction*" results from a tendency to be sensitized to the expectations and preferences of others, this representing the newest character type, emerging in the society where the population is once again static. The existence of over-lapping types is carefully emphasized. Most of the volume consists of a comparison of these three character types in various spheres of life, including morality, work, literature, communication, play, politics, and personal adjustment.

Riesman does not see character-conformity as inevitable for the individual and introduces the concept of "*autonomy*" to describe the individual who is capable of conforming, but is also (presumably emotionally) free to decide whether he wants to conform. In encouraging autonomy, Riesman sees hope for the "Lonely Crowd."

This book is almost too well written, in the sense that challenging concepts tend to be lost in the mass of well-verbalized documentation. It should be of particular interest to Canadian social scientists, who live in a country where "other-direction" is not so far advanced, but is rapidly developing. Clinicians will find the book's concepts useful in understanding many problems of personal adjustment.

Charles Shagass

Allan Memorial Institute of Psychiatry
McGill University

Theoretical Foundations of Psychology. Edited by HARRY HELSON. New York: Van Nostrand, 1951. Pp. xix, 787. $8.75.

THIS BOOK was designed by the editor "to treat the fundamental ideas, concepts, theories and problems which are at the centre of the chief divisions of" psychology. Its specific function is to deepen and broaden the student's view of present-day psychology by the means of the following fifteen chapters:

Methodological Considerations—Malcolm G. Preston
Some Problems of Nervous Function—Jane M. Oppenheimer
Some Neurological Correlates of Behavior—Edward Girden
Development and Maturation—Nancy Bayley
Motivation—Francis W. Irwin
Feeling and Emotion—J. G. Beebe-Center
Fatigue and Efficiency—S. Howard Bartley
Perception—Harry Helson
Learning—Edwin B. Newman
Thinking—Harry F. Harlow
Measurement in Psychology—J. P. Guilford and Andrew L. Comrey
Intelligence—Jane Loevinger
Personality—Donald W. MacKinnon and A. H. Maslow
Psychological Theory and Social Psychology—David Krech
Abnormal Psychology—D. B. Klein

What impresses this reviewer most is that each author had a point of view which he freely used in the selection and organization of the topic assigned to him in the text. This resulted at times in the omission of certain aspects of current interest. For example, Girden omitted reference to Köhler's and Hebb's recent work; Bayley omitted social influences on development as well as the work of Werner, Piaget, and Bühler. In some chapters the author only attempted to survey the field. In others the author ended his chapter with an attempt at a systematic theory of his own—for example, Helson in "Perception," Beebe-Center in "Feeling and Emotion," and Newman in "Learning."

Since the various authors differ in their basic orientation to psychology, instructors using this book should encourage their students to find out and analyse the basic assumptions used by the authors. In this way it may serve as an excellent and stimulating introduction to the main problems and issues of contemporary psychology. It would be unfortunate if the book as it stands were taken to describe *the* contemporary theoretical foundations of psychology.

ABRAHAM S. LUCHINS

McGill University

Psychological Theory: Contemporary Readings. Arranged and edited by MELVIN H. MARX. Toronto: Macmillan Company, 1951. Pp. xi, 585. $5.00.

AT FIRST GLANCE this collection of important theoretical papers, first published during the last two decades, appears to form a valuable compendium of readings for use in courses in modern psychological theory. The reviewer himself teaches such a course, and has felt the need for "a single collection of the most useful and representative papers"—a need augmented by the antipathy that librarians have to lending journals, especially to undergraduates. On a closer look, however, it turns out that the title of the book is somewhat misleading. It is not a book on modern or contemporary psychological theory; rather it seems to be concerned primarily with scientific methodology as applied to psychological research and theorizing.

Actually the book is divided into two parts: Part I contains papers on "problems of scientific theory construction in psychology"; the second part is "an anthology of representative writings from the most prominent contemporary psychological theorists." In the opinion of the reviewer, the second part, constituting roughly one-third of the entire collection, makes no significant contribution to the usefulness of the book: in the space of less than 200 pages the editor squeezes in 24 papers, by 25 different authors, ranging all the way from Köhler, Hull, and Tolman to Freud, Kardiner, and Horney. The student who is not already familiar with these authors is likely to find the writings too brief to be valuable, and the student who is well-acquainted with the authors' theorizing will find little to interest him in these pages.

The first part of the book is a different story. It deals with scientific theory construction, and would probably have made a worthwhile compilation in itself. This section contains 23 carefully selected papers, including the one written especially for the book by the editor. The more important of the recent articles on such topics as operationism, theoretical constructs, and levels of explanation, by men like Stevens, Tolman, Hull, Allport, Meehl, MacCorquodale, Spence, and Marx himself, are to be found here. Ten of the selections are concerned with "special techniques," such as Hull's hypothetico-deductive method, Thurstone's factor analysis, field-theoretical and phenomenological approaches, and psychoanalysis.

As a collection of papers on the important topic of problems and methods of scientific theory construction, Marx's *Psychological Theory* will certainly be used extensively in many psychology seminars and advanced undergraduate courses. But I should hesitate to recommend it

as a basic textbook for a general course in modern psychological theory. An excellent index is provided to facilitate its use as a general reference book, in which role it is likely to be of the greatest service to students and teachers alike.

DALBIR BINDRA

McGill University

Rorschach Introductory Manual. By GEORGE ULETT. St. Louis: Educational Publishers, Incorporated, 1950. Pp. 44. $3.00.

THE PURPOSE of this manual in the author's words is "to present an aid to learning the Rorschach test that will facilitate its more rapid mastery." His short cuts consist of: (1) a table with the essential scoring data, so that the beginner will not have to remember the many unfamiliar symbols; (2) another table listing the common responses to each card to enable the beginner to score usual or unusual answers without learning the usual responses by giving many tests; and (3) a very colourful diagram in the shape of a wheel showing the relationships between various scores with interpretative descriptions to enable the beginner to translate the symbols into a personality picture.

The rest of the manual is the usual approach to the Rorschach administration, scoring, interpretation, and clinical diagnosis. It is a brief summary but good condensation of Klopfer's and Beck's methods.

The three visual aids will undoubtedly serve their purpose to the novice. However, the author himself cautions the reader by stating that the diagram is "eclectic and simplified." The reviewer hopes that all beginners will heed the author's warning and remember that this is only an *introductory* manual.

DORIS C. WARNER

Queen's University

BOOKS RECEIVED*

ALEXANDER, FRANZ and ROSS, HELEN (Editors). *Dynamic Psychiatry.* Chicago: University of Chicago Press, 1952. Pp. xii, 578.

BELLAK, LEOPOLD *et al. Manic-Depressive Psychosis and Allied Conditions.* Toronto: Ryerson Press, 1952. Pp. xiii, 306.

BERGLER, E. *Neurotic Counterfeit Sex.* Toronto: Ryerson Press, 1951. Pp. xii, 360.

BETTELHEIM, B. *Love Is Not Enough.* Toronto: Burns and MacEachern, 1950. Pp. ix, 386.

BRITT, S. H. (Editor). *Selected Readings in Social Psychology.* New York: Rinehart and Company, 1950. Pp. xvi, 507.

BRUNSWICK, EGON. *The Conceptual Framework of Psychology.* Chicago: University of Chicago Press, 1952. Pp. iv, 102.

BURNHAM, P. S. and PALMER, S. H. *Counselling in Personnel Work: 1945–1949. An Annotated Bibliography.* Chicago: Public Administration Service, 1951. Pp. 39.

Canadian Social Science Research Council. *Canadian Graduate Theses in the Humanities and Social Sciences, 1921–1946.* Ottawa: The Bibliographic Centre, Public Archives, 1951. Pp. 194.

CANFIELD, N. *Audiology: The Science of Hearing.* Toronto: Ryerson Press, 1949. Pp. ix, 45.

CORY, D. W. *The Homosexual in America. A Subjective Approach.* New York: Greenberg, 1951. Pp. xvii, 326.

Dalton Schools Monographs:

CLARK, E. *The Nursery School Procedure.* New York: Dalton Schools, 1949. Pp. 96.

COY, G. L. *Ways Toward Self-Discipline.* New York: Dalton Schools, 1950. Pp. 95.

HODGES, N. *Community Service in the Dalton School.* New York: Dalton Schools, 1949. Pp. 64.

GARRISON, KARL C. *Growth and Development.* Toronto: Longmans, Green and Company, 1952. Pp. xii, 559.

HARROWER, H. R. and STEINER, M. E. *Large Scale Rorschach Techniques.* Toronto: Ryerson Press, 2nd Edition, 1951. Pp. xx, 353.

HAVIGHURST, R. J. and MORGAN, H. G. *The Social History of a War-Boom Community.* Toronto: Longmans, Green and Company, 1951. Pp. xix, 356.

(*To be continued*)

*The inclusion of a book in this list does not necessarily preclude a review of it appearing in a later issue of the *Canadian Journal of Psychology*.